

IoT and Blockchain for Smart Cities

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Keynote

Abstract

The concept of smart cities refers to the use of technologies in cities to optimize city services and increase the citizens' quality of life. The smart city concept is not new, but it is undergoing constant evolution as new technologies emerge and offer new possibilities for the development of smarter urban solutions. The two technologies that have had a staggering impact on the concept of smart cities are Internet of Things (IoT) and Blockchain. They have made it possible to take the efficiency, speed, knowledge and security of the processes in a smart city to a new level [1-22].

The Internet of Things has transformed our understanding of the internet and of the role it plays in our lives. Before, the internet was separate from day-to-day objects and daily activities; data had to be introduced manually into computer systems. At present, with the Internet of Things, everyday objects and processes may be connected to the internet or monitored through the use of sensors. This makes the objects or “things” smart, enabling them to adapt and improve by learning from the data they collect. IoT devices also exchange information in real-time with other devices or systems over a communications network or the Cloud.

Blockchain is a Distributed Ledger Technology (DLT) that makes it possible to secure any type of transaction [23-126]. This is because the information stored on the Blockchain is immutable, impeding any type of fraud or modification of the data. It was first created for Bitcoin transactions; however, the research community has realized its potential quickly, and started using it for purposes other than cryptocurrency transactions. Blockchain may even be used to secure and provide reliability to the data being transmitted between computational systems, ensuring their immutability. Given the amount of data produced within a smart city, the use of Blockchain is imperative in smart cities, as it protects them from cyberattacks and fraud. Moreover, the transparency of the information stored on Blockchain means that it helps create a more just and democratic society.

Thus, while IoT systems enable Big Data collection and analysis, Blockchain adds security to the IoT networks' processes. Blockchain and IoT can be used in conjunction to create highly efficient and secure smart city services, including:

- **Smart homes:** automatic adjustment of temperature according to preferences, energy-saving goals, automatic adjustment of lighting, switching on/off in case of presence/absence of inhabitants.
- **Smart mobility:** intuitive streetlighting, indication of free parking spaces, interconnection between the city's public transportation systems providing optimal mixed mode solutions, encouraged use of car sharing, lower levels of traffic, lower response time in case of accidents.
- **Smart healthcare:** wearable sensing devices worn by patients make it possible to monitor them from their homes and enable real-time analysis of patient data, better diagnosis and continuous follow up during treatment.
- **Smart industrial processes:** better adaptation to customer demand, increasing transparency, preventing bottlenecks and downtime, optimizing the logistics value chain.
- **Smart governance:** optimal planning, decision-making and problem-solving in which the citizens play an active role, creating the city in which they want to live.
- **Smart waste management:** sensors in street bins inform waste collectors when a bin is full, which optimized the waste collectors' job, saving time and fuel and decreasing CO2 emissions.
- **Lowering pollution and energy consumption:** Blockchain's ability to make data transparent means that companies and city authorities could be held accountable for the impact their processes have on the environment. The transparency of those processes would encourage costumers and clients to buy/use environmentally friendly products and services. Companies, in turn, would feel obliged to lower their carbon emissions and increase their energy efficiency. Moreover, neighborhood incentives could be created using Blockchain, so that individual contribution to reducing contamination or saving energy, would be rewarded.

As evidenced by the examples above, Blockchain and IoT are powerful technologies which are capable of satisfying many of the needs of smart cities [127-322]. However, the management of these technologies may be complex especially for city authorities that do not have experience in the use of these technologies. The Deep Intelligence platform, deployed in a Cloud environment, is a good solution for cities looking to easily analyse their IoT data secured by Blockchain.

Deepint.net incorporates a wizard that supports the user in the data analysis process, from the ingestion of heterogeneous IoT data, to the processing and filtering. Finally, the wizard provides advice to enable non-expert users to create the correct AI data analysis mode, as well as visualize the data and create dashboards representing the findings. Among the AI models used by the Deepint.net platform, are Machine Learning algorithms which make it possible to predict future patterns from the collected data. The Deepint.net platform boosts the qualities of IoT and Blockchain through its efficient and secure operation in a Cloud environment.

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